

Silicon Wafer X-ray Mirror Project

Completed Technology Project (2013 - 2014)



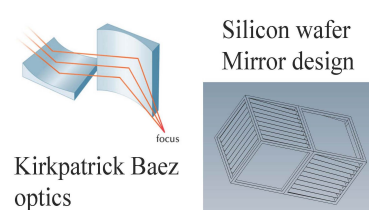
Project Introduction

We propose to undertake the initial development of a Kirkpatrick-Baez (K-B) type X-ray mirror using the relatively recent availability of high quality, inexpensive, silicon wafers as reflectors. Proof of suitability will lead to the fabrication of a new class of lightweight X-ray mirrors for astronomical observations with suitably large effective area and moderate spatial resolution. We intend to build a demonstration unit, which uses multiple silicon wafers aligned in a housing structure, and test it with X-rays to show angular resolution, $<30''$, at the end of the project.

In this one year research project, we propose to do the following four tasks; (1) Design the silicon wafer X-ray mirror demo unit and develop a ray-tracing code to estimate the mirror performance. We will need to determine detailed parameters of the unit, such as size of the silicon wafer, their angle and pitch. (2) We have to find a wafer processed by the "right" method suitable for our application: appropriately flat and thin. We will procure the silicon wafers and measure the surface flatness using an optical interferometer. (3) Design a holding structure of the silicon wafer and place them in the K-B system configuration. The structure should be able to place the wafers in micron accuracy. If the machining accuracy doesn't allow us to do this, we would need to develop a method to align the wafer. (4) Once we have the manufacturing drawing, we will need to identify the manufacturer and fabricate the designed housing. Then we will assemble the first demonstration unit, and measure its performance at the X-ray beamline. The X-ray test results will be compared with ray-tracing simulations and used for the further developments in the future.

Anticipated Benefits

Would provide low cost, lightweight, high angular resolution X-ray mirrors for a variety of astronomical observations, especially for small experiments/missions for spectroscopy and polarimetry.



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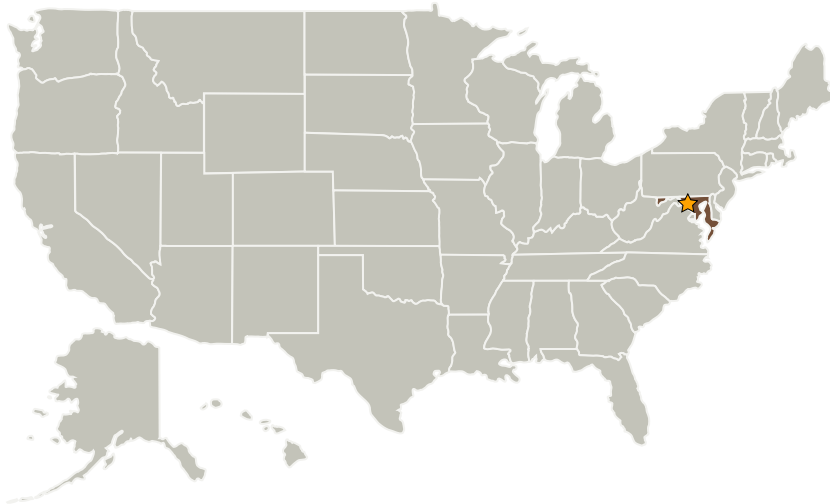
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Goddard Space Flight Center (GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Innovation Fund: GSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Peter M Hughes

Project Manager:

Stanley D Hunter

Principal Investigator:

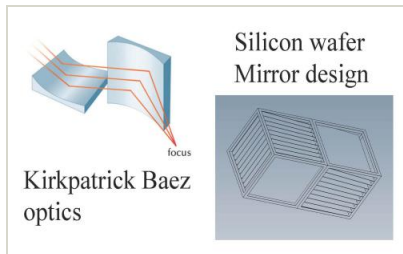
Takashi Okajima

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Images



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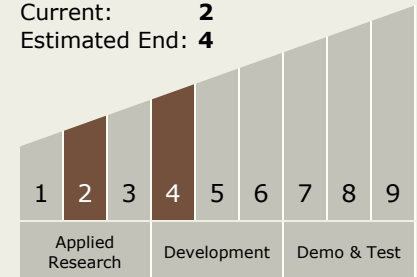
Silicon Wafer X-ray Mirror Project
(<https://techport.nasa.gov/image/3282>)

Project Website:

<http://sciences.gsfc.nasa.gov/sed/>

Technology Maturity (TRL)

Start: 2
Current: 2
Estimated End: 4



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.2 Observatories
 - └ TX08.2.1 Mirror Systems